Introduction/Safety

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Introduction

Objective

Provide service documentation that is consistently organized, easy to access and is designed to aggressively expedite fault isolation and decrease product down-time.

Scope

This manual's contents document the subsystem specified on the title page. Subsystem descriptions, fault isolation, functional tests and adjustments generally address only components and assemblies within the subsystem. However, some information and procedures may document the subsystems operation as a system used with other subsystems. Other documents that may be referenced here and included as a complete set of system documentation are:

- Other Subsystem service manuals
- Periodic Maintenance (PM) Procedure and PM Report
- Installation Procedure and Installation Report
- Illustrated Parts Manuals
- Schematics

Service Philosophy

Medical Imaging Systems use precision components and utilize complex manufacturing techniques. Component-level repairs that maintain compliance with these requirements are sometimes not possible in the field. The system is therefore designed to be field serviceable at the modular or Field Replaceable Unit (FRU) level.

Qualifications

Reading this manual does not qualify an untrained person to service the equipment. This publication assumes the reader is a skilled and fully qualified electronic technician who has experience servicing medical imaging systems. Factory trained service personnel will benefit the most from this material.

Unauthorized Modifications

GE OEC Medical Systems, Inc. certifies that when assembled according to the manufacturer's instructions, this equipment meets US Federal Performance standard 21 CFR Subchapter J and applicable international standards. Unauthorized modifications to the equipment may impact adherence to these standards and make the equipment unsafe to operate.

The owner is responsible for verifying continued compliance with all applicable regulations and standards. Consult local, state, federal and/or international agencies regarding specific requirements and regulations applicable to the use of this type of medical electronic equipment.

Certified Components

In the USA, requirements exist for reporting the repair and replacement of certified components. Refer to GE OEC standard operating procedures for more information.

Manual Organization and Use

The subsystem documented here has been analyzed and divided into functional sections. Each functional section has a corresponding section in this manual. Each functional section contains the following types of information:

Circuit/mechanical Descriptions – circuit and mechanical descriptions that discuss the functional section of the subsystem.

Fault Isolation – flowcharts and tables that guide the fault isolation process.

Functional Tests – tests that determine if equipment is working correctly.

Adjustment – procedures for tuning electronic circuits and mechanical components.

Miscellaneous – may include PCB assembly drawings with test points and electronic components that correspond to circuits in the functional tests.

Additional sections found in this manual, document information that is relevant at the subsystem level. Sections documenting subsystem information are:

Subsystem – identifies major assembly and control locations and other information relevant at the subsystem level.

Diagnostics – provides messages, control panel indications, hexadecimal codes, LEDs, software utilities and diagnostic programs that expedite the diagnostic process.

Replacement – removal and installation procedures for fuses, covers and field replaceable units.

Calibration – calibration procedures relevant at the subsystem and system level.

Safety

Do not attempt to service or maintain this equipment before reading this entire section.

Safety Hazard Alerts

There are three hazard classifications used in this document. They are:

1. Danger
2. Warning
3. Caution

This table defines the alert used for each type of hazard classification:

Alert	Circumstances for Use
DANGER	Danger indicates an **imminently** hazardous situation which, if not avoided, will result in death or serious injury.
WARNING	Warning indicates a **potentially** hazardous situation which, if not avoided, could result in death or serious injury.
CAUTION	Caution indicates a **potentially** hazardous situation which, if not avoided, may result in moderate to minor injury, equipment damage or loss of data.

Ingress of Fluids

Excessive amounts of fluids such as antiseptics, cleaning solutions or bodily fluids may damage internal components if they are allowed inside the equipment.

WARNING: *The equipment is not rated for water-tight operation. Do not allow any liquids to leak into the equipment where they can cause electric shock, fires, and short circuits. If leakage does occur, ensure that all internal circuitry is completely dry before attempting to operate the equipment.*

WARNING: *Never store or operate the system in the presence of conductive fluids like water or saline solution unless the system is adequately protected by an approved bagging or draping system.*

Electrical Shock

If the equipment must be serviced with the covers removed, observe the following precautions:

WARNING: *Equipment that contains high power electrical components must be serviced only by personnel familiar with proper safety procedures for working near these components.*

DANGER: *Disconnect AC power (and battery packs if used) before discharging static electricity in components such as electrolytic capacitors and high voltage cables. Failure to heed this message **will** result in death or severe personal injury.*

Allow adequate time for static charges to discharge through bleeder resistors. Use a high wattage resistor when discharging circuits to avoid burns.

WARNING: *Have someone watch while you work near high voltages. This person must remain clear of all circuitry and be prepared to turn off the power to the system and render aid in an emergency.*

WARNING: *High voltage cables, electrolytic capacitors, and CRTs can retain a dangerous static charge for long periods after power has been removed. Some devices can acquire a charge spontaneously without direct contact with other circuitry. **Do not** touch these components unless power has been completely removed and they have been discharged.*

***WARNING**:* *Systems with battery packs can deliver high currents at high voltage. Electric shock from batteries can cause death or personal injury, including severe burns. Use extreme caution when working on circuits energized by or located near the batteries. Batteries are dangerous at all times. Setting the battery pack circuit breaker to off removes battery current from other circuitry, but **does not** render the batteries harmless.*

***CAUTION**:* *Never operate the system unless all potential equalization conductors (green wire with a yellow stripe) and related components are fastened in place. Dangerous electrical shock and improper equipment operation can otherwise result.*

***CAUTION**:* *Remove all metal rings and watchbands before working on system circuitry. Skin burns and damage from involuntary muscle contractions can result if metal jewelry shorts electrical circuits.*

***WARNING**:* *Systems with batteries should not be shipped with exposed battery terminals. Use factory-supplied shipping containers that cover the terminals with insulating material and are strong enough to contain the weight of the batteries during rough handling.*

Implosion

If the equipment has a Cathode Ray Tube (CRT) do not locate objects so that they might fall and strike the tube causing it to implode. Use caution when working around the tube. The coating on the glass can also produce toxic dust and fumes. If a CRT implodes:

1. Remove power immediately.
2. Evacuate the area.
3. Contact site administration regarding hazardous material disposal.

Explosion

If the system complies with the requirements of IEC 60601-1 regarding Anesthetic Proof (AP) equipment, an AP label will be located on the equipment. An AP label means that under normal conditions certain components may be operated safely in close proximity to flammable gases.

However, if an abnormal condition occurs, such as the room fills with flammable gas, steps must be taken to prevent the gas from contacting non AP rated components within the equipment. Follow these guidelines:

1. Do not turn the system on or off.
2. Do not un-plug or plug-in system or peripheral equipment power cords.
3. Do not operate light switches or other electrical equipment.
4. Evacuate all personnel immediately.
5. Notify the hospital administration and/or fire department.
6. Ventilate the room to clear the air of all flammable vapor or gas.
7. Identify and remove the source of the flammable liquid, vapor, or gas.

Equipment Stability

If the system is mounted on wheels and casters and it is moved or operated improperly it could roll out of control. Follow these guidelines:

- Two people should maintain control of the equipment when moving up or down an incline.
- Place all mechanical assemblies in their most compact (transport) position and lock brake handles prior to moving the equipment.
- Use the handles designed for moving the equipment and mechanical assemblies.
- Never attempt to move the system up or down steps.
- Do not operate the equipment on unlevel floors.
- Do not lock the wheel brakes and leave the equipment unattended on unlevel floors.

- Always apply the wheel locks when the system is in its final position.
- Do not move the equipment if the castors or wheels are not functioning properly.
- Mechanical shocks to the equipment while disk drives are accessing information may cause damage to the disk drive and loss of data.

X-Radiation

***CAUTION**:* *This equipment either produces or is used in the vicinity of ionizing radiation. Observe proper safety practices during operation. Use lead aprons, eye protection, thyroid protection, and similar devices to protect yourself and others.*

Motorized Mechanical Movement

If the equipment has motorized mechanical assemblies follow these guidelines:

- Always observe mechanical assemblies when operating the motor to avoid pinching or collision with a person or object.
- Use care when working around equipment to avoid unintentional motor actuation. Do not carelessly place objects on the equipment or bump or lean against the equipment.
- Observe and prevent articles of clothing from getting caught in moving parts.

Safety Interlock

***WARNING**:* *Never bypass, jumper, or otherwise disable any equipment safety feature.*

Warning Labels

Heed all warning labels that are attached to system components:

***Note**: Even though this manual is supplied only in English, some labels may have a foreign language equivalent that will appear on your system.*

Symbols

Be familiar with the following symbols that may appear on equipment and schematics so you can safely maintain and operate the system:

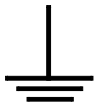
Dangerous Voltage

This symbol identifies areas where hazardous voltages may be present. Use appropriate safety precautions.

Protective Earth Ground

This symbol identifies the system's main protective earth ground terminal, which connects to the facility earth ground through the grounding prong on the AC power plug. This connection must be in place at all times for safe system operation.

Earth Ground Connection



This symbol identifies an earth ground connection that is necessary to maintain grounding throughout the system.

X-Ray Source

This X-Ray Source symbol is used to identify controls that will produce ionizing X-radiation when activated. Always use appropriate safety precautions when generating X-rays.

This X-Ray Source symbol is used to identify controls that will produce ionizing X-radiation when activated. Always use appropriate safety precautions when generating X-rays.

This X-Ray Source symbol is used to identify controls that will produce high levels of ionizing X-radiation when activated. Always use appropriate safety precautions when generating X-rays.

Potential Equalization Terminal

This symbol identifies system terminals which, when connected together, are at the same potential (not necessarily earth ground). Green/yellow wires normally connect potential equalization terminals together.

Anesthetic Proof Equipment

This symbol identifies components on the equipment that have been rated as Anesthetic Proof (AP). Refer to the *Explosion* subheading in this section for more information.

Attention

Attention, see accompanying documentation for information.

Focus

This symbol marks the approximate location of the x-ray tube focal spot projected on a straight line at angles to the central axis of the beam.

Type B

This symbol indicates the equipment is protected against electric shock by a protective earth ground connection.

Required Tools and Equipment

- Beam Alignment Tool (00-**871980)**
- Converging line pair tool (00-900860)
- Wisconsin mesh tool (00-900040)
- Serial cable (00-901559)
- 1 mm sheet of copper (00-877682)
- Six 5 x 30 x 30 cm thick sheets of Plexiglas
- Utility Suite Software (00-883763)
- AT keyboard (00-900598)
- Nine-inch VGA monitor (00-901163)
- Dosimeter with 15 cc and 150 cc Ion Chambers
- Digital Volt Meter
- Lead Apron
- Tektronix Photometer
- Fostec Calibrated Light Source
- Fostec Light Source Control PCB (00-882068)
- UroView Boot and Diagnostic Disk (00-876781)